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ABSTRACT

The literature is reviewed to see if research shows a relationship between student and teacher performance and air conditioning of classrooms. The benefits of air conditioning in promoting learning are substantiated by studies that are summarized but not cited. The relationship of the report to the Phoenix Union High School System Advisory Council's high priority on air conditioning and the North High School air conditioning project is mentioned. (MLF)

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# PHOENIX UNION HIGH SCHOOL SYSTEM

## THE EFFECT OF AIR-CONDITIONING ON STUDENT AND TEACHER PERFORMANCE

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DEPARTMENT OF RESEARCH AND PLANNING
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## THE EFFECT OF AIR-CONDITIONING ON STUDENT AND TEACHER PERFORMANCE

### INTRODUCTION

Is air-conditioning a luxury that has little or no bearing upon student and teacher performance and attitudes? Central heating was thought to be such a luxury a hundred years ago, but now is commonplace.

It is becoming increasingly popular for schools to be air-conditioned: For example, in Houston and Dallas renovation programs incorporated the air-conditioning of nearly 400 schools and sealed these buildings against outside heat, humidity and noise. In Florida a new public school designed without air-conditioning does not qualify for a bond issue (State statute).

The purpose of this report is to review the research literature to see if research shows a relationship between student and teacher performance and air-conditioning of classrooms. This subject is particularly important at this time in light of the Phoenix Union High School System Advisory Council's high priority on air-conditioning and the North High School air-conditioning project.

### RESEARCH RESULTS:

The benefits of air-conditioning in promoting learning are substantiated by an accumulating amount of evidence. Many experimental studies conducted in the United States and Europe have established the connection between air-conditioning and academic achievement.

One of the earliest and most convincing experiments that substantiate this theory was conducted in 1962 at the University of Iowa. In the experimental room ideal conditions of temperature, relative humidity and air motion were established. In the other classroom

temperatures varied from 72 degrees Fahrenheit to 81 degrees Fahrenheit (a rather cool day in Phoenix in late May). However, after only three weeks of work the children in the air-conditioned room displayed greater progress than their less comfortable counterparts. In reasoning tasks they demonstrated greatest improvements.

In a rigorously controlled experiment at Kansas State University 72 college students subjected to controlled temperatures learned most easily at room temperatures as compared with students where temperatures were allowed to soar to 92 degrees Fahrenheit. Improvements were found in (A) time to complete assignments, (B) reduction of error rate, and (C) effort required to learn. (Effort was subjectively judged).

In cooler Sweden a team of researchers found that a group of ten year olds performance was considerably less in language learning, arithmetic, ability, spelling, reading speed, and comprehension at temperatures ranging from 81 degrees to 86 degrees Fahrenheit when compared with students where temperatures were controlled. Moreover the degree of learning loss was found greatest among those who worked closest to the limit of their mental capacity.

A more recent and more ambitious Dunlop and Associates experiment (elaborately designed to eliminate extraneous factors) found a strong relationship of air-conditioning and improved academic performance at elementary, junior high, and high school levels.

A comparison was made of one climate controlled school with non-climate controlled schools of similar size with respect to factors of cost and outcome in the Pinalas County (Florida) Public School System. Achievement gains were greater in the climate controlled schools in four comparisons and equal in two comparisons. In no

case were they less in non-climate controlled schools.

A University of Iowa study described the effect of thermal environment on learning. This study was designed to determine the difference, if any, in learning between a group of students in a model thermal environment and another group in a marginal thermal environment. Learning in this experiment was measured by the number of direct responses to a repeated series of ten paper and pencil tasks. Within the limitation of this experiment (using the selected tasks and using fourth grade students) the experiment showed that thermal control is strongly related to achievement gains. In every task the experimental group which occupied the room with model thermal conditions improved more than the control group. Some of these gains, however, were not statistically significant, but the experimental group did show superiority (statistically significant) for all reasoning and some clerical tasks.

Few studies have been done to find the relationship between teacher performance and air-conditioning, but teachers' attitudes toward air-conditioning and its effect on the learning process have been surveyed, and not surprisingly the teachers overwhelmingly affirmed that air-conditioning aids in the learning process. If a happier teacher is a better teacher then air-conditioning will predictably improve teacher performance. Ninety-six percent of teachers in a survey conducted in Portland, Oregon for example, favored air-conditioned classrooms (Portland is relatively cool). Los Angeles teachers expressed their preferences in stronger terms; i.e., by striking, and demanded air-conditioning throughout the school system as part of a settlement. It appears that air-conditioning would improve teacher morale.

Manning and Olsen studied the effect of air-conditioning upon teachers' performance. Teachers replies indicated that their effectiveness and comfort increases in air-conditioned classrooms. Absenteeism was reduced both by students and teachers when the thermal environment was controlled.

Air-conditioning is, of course, most economically installed at the time of original construction. It always costs more when added later. However, certain economies have been suggested by the research literature, even for modernization projects such as North High School. It can be expected, for example, that because of the filtered air the interior maintenance problems will be less than if using the natural environment.

CONCLUSIONS/INFERENCES:

1. There is considerable evidence that students in air-conditioned classrooms achieve more than like students in non-air-conditioned classrooms.
2. The air-conditioning of North High School is a good investment, not only for the comfort of students and staff, but for actual student achievement gains. Students at North will be better prepared for life beyond high school than they otherwise would be in non air-conditioned classrooms.
3. It would be inappropriate, however, to compare North High School students in 1973-74 (air-conditioned) to North High School students prior to the time the school is air-conditioned. The antecedent conditions are changing too rapidly (student abilities, etc.).
4. Teachers will likely perform better in air-conditioned classrooms than in a natural environment.
5. Attitudes and attendance of both students and staff will likely improve when their classrooms (school) become air-conditioned.